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LOWER TRIASSIC SALT RANGE NAUTILOIDS

BY BERNHARD KUMMEL

INTRODUCTION

Triassic nautiloids in contrast to the ammonoids are not abundant in the fossil record nor are they very diverse in kinds. A monograph in press by the writer on late Paleozoic and Triassic nautiloids demonstrates that the evolutionary pattern of Triassic nautiloids is merely a culmination of trends that started in the Carboniferous. There is no marked change in nautiloid evolution at the Permo-Triassic boundary. In contrast to this pattern the ammonoids suffered severe extinction in the Permian, and in the early Triassic went through an "eruptive" development of numerous new stocks. For both the ammonoids and the nautiloids the Triassic-Jurassic boundary was a period of greater crisis. Only one stock of ammonoids survived to give rise to the great host of forms known in the Jurassic and Cretaceous. The nautiloids likewise became nearly extinct at the end of the Triassic but a stock probably out of the Syringonautilidae led to a new but more modest radiation of the group.

Of the approximately 250 species of Triassic nautiloids in 30 genera, 17 are from the Scythian, 74 from the Anisian, 28 from the Ladinian, 90 from the Carnian, 39 from the Norian, and none is certain from the Rhaetian. The Lower Triassic or Scythian species are the only ones that will be mentioned here. These Lower Triassic nautiloids include: *Metacoceras* (*Mojssaroceras*) *subaratum* (Keyserling) 1860, from northern Siberia; *Pleuromutilus dicneri* Krafft and Diener, 1909, *Grypoceras* (*Grypoceras*) *brahmanicum* (Griesbach) 1880, *Grypoceras* (*Grypoceras*) *hexagonalis* Diener, 1897, *Grypoceras* (*Grypoceras*) *lilangense* Krafft and Diener, 1909, from the Himalayas; *Pleuromutilus subquadrangulus* Tien, 1933, from south China; *Pleuromutilus kokeni* Frech, 1905, *Tainionutilus trachyceras* Frech, 1905, *Menuthionutilus kieslingeri* Collignon, 1933, *Grypoceras* (*Grypoceras*) *bidorsatoides* n. sp.,

Grypoceras (*Grypoceras*) *acmulans* n. sp. from the Salt Range, Pakistan. *Menthionautilus kieslingeri* was originally described from Scythian strata of northern Madagascar (Collignon, 1933). The Lower Triassic Dinwoody and Thaynes formations of Idaho have yielded new species of *Mojaveoceras*, *Pleuroautilus*, *Euoploceras*, *Germanonautilus*, and *Grypoceras*. The descriptions of these new species are in press (Kummel, 1953). Muller and Ferguson (1939) list *Grypoceras* cf. *brahmanicum* (Griesbach) from the Candelaria formation of Nevada.

In the *Lethaea Geognostica* (Frech, 1903-1908), in the chapter on the Asiatic Trias (written by Fritz Noetling), there are described two species of nautiloids from the Lower Triassic of the Salt Range. These are *Tainionautilus trachyceras* from the Ceratite Sandstone (zone of *Flemingites flemingianus*) and *Pleuroautilus kokeni* from the Upper Ceratite Marls (zone of *Koninckites volutus*). The chapter on the faunal characteristics of the Salt Range Lower Triassic formations states that there are 5 to 6 species of nautiloids of which 4 to 5 species are undescribed (Frech, 1903-1908, pp. 167-168). These undiagnosed specimens of nautiloids from the Lower Triassic formations of the Salt Range are in the British Museum of Natural History as part of the Koken Collection and are described here. Besides the three species described below, there are two specimens of *Pleuroautilus* (B.M.N.H. C10429 and C10426) from the Ceratite Marls, Chideru, Salt Range, to which Koken had applied manuscript names but they are too poorly preserved to warrant description.

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SYSTEMATIC DESCRIPTIONS

Family GRYPoceratidae Hyatt, 1900

Genus GRYPocERAS Hyatt, 1883

Type species. *Nautilus mesodicum* Hauer, 1846.

There are approximately 22 species of Upper Paleozoic nautiloids assigned to *Domatoceras* (type species, *Domatoceras umbilicatum* Hyatt, 1891). They are characterized by being flattened ventrally and laterally and slightly impressed dorsally. The sutures form rounded

ventral, lateral, and dorsal lobes. The siphuncle is subcentral in position and orthochoanitic. Species of *Domatoceras* show much variation in the degree of involution and in the position of the siphuncle.

The Triassic genus *Grypoceras* has long been recognized as very similar to late Paleozoic domatoceratids (Mojsisovics 1902, p. 227). *Grypoceras* differs from *Domatoceras* in generally being more involute, the ventral area more rounded, the lobes more concave, and in having an annular lobe. The Lower Triassic grypoceratids are especially similar to typical domatoceratids. The degree of involution of 12 species of *Domatoceras* shows the percentage of the diameter of the umbilicus to the diameter of the conch to range from 16 to 50. The two most involute species, *D. kleihegi* (17%) and *D. moorci* (16%), are transitional forms to *Stenopoceras*. The same data on 9 species of *Grypoceras* show a percentage range from 8.5 to 30. Species of both genera, likewise, show variability in the position of their siphuncle. The Lower Triassic species of *Grypoceras* have angular ventral shoulders, the Middle and Upper Triassic species generally have more rounded shoulders. These data suggest that *Grypoceras* is a direct evolutionary continuation of the late Paleozoic *Domatoceras*, and the two genera are gradational in most characters. The principal differences are in the presence of an annular lobe and the greater involution of *Grypoceras*. Under these circumstances full generic status for *Domatoceras* does not seem warranted and it is here placed as a subgenus of *Grypoceras* since the latter genus has priority.

Grypoceras is widely distributed geographically, being more or less common in the Alpine and Himalayan Triassic regions. It is also reported in Triassic rocks from North America, the Ussuri region, Timor, and New Zealand. Stratigraphically it is equally widespread. There are five species in the Scythian, eight in the Anisian, three in the Carnian, three in the Norian, and there is a form allied to *G. mesodicum* in the Rhaetic of Kossen (Mojsisovics, 1873, p. 22).

GRYPOCERAS (GRYPOCERAS) BIDORSATOIDES (Koken MS) n. sp.

Plate 1, figures 1, 2

This species is based on one well preserved specimen of phragmocone and living chamber. It measures 55 mm. in diameter, 27 mm. in height of the last whorl, and 30 mm. in the width of the last whorl. The umbilicus is 8 mm. in diameter. The whorl section is subquadratic in outline. The flanks are flattened and converge toward the venter. The

venter is flattened on the phragmocone and becomes concave on the living chamber. The ventral shoulders are rounded and prominent. The umbilical shoulders are more broadly rounded and the umbilical wall is vertical. The shell is preserved on parts of the conch and is smooth except for faint lines of growth. The septa form a broad, shallow, ventral and lateral lobe. The siphuncle is in a subventral position, being only 4 mm. from the venter at a point where the whorl height is 22 mm.

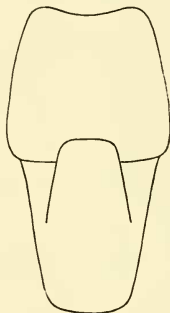


Fig. 1. Diagrammatic cross-section of *Grypoceras* (*Grypoceras*) *bidorsatoides* n. sp., X1.

Remarks. *G. (Grypoceras) bidorsatoides* is closely related to *G. (Grypoceras) brahmanicum* of the *Otoceras* beds of the Himalayas. The Salt Range species is more involute and more depressed in cross section. The siphuncle of *G. (Grypoceras) brahmanicum* is in a near ventral position in the early whorls but on the last whorl has a position closer to the center of the whorl. *G. (Grypoceras) lilangense* from the "*Meckoceras*" beds of the Himalayas has a very rapidly expanding and large conch, and no comparison can be made with *G. (Grypoceras) bidorsatoides*. The Dinwoody formation in Idaho has yielded a new species of *Grypoceras* that is somewhat similar to this Salt Range species but more compressed and with a high whorl section. Except for greater involution, *G. (Grypoceras) bidorsatoides* is similar to several species of upper Paleozoic domatoceratids.

Occurrence. Lower Ceratite Marl, zone of *Prionolobus rotundatus*, Chideru, Salt Range, Pakistan.

Repository. B.M.N.H. C10428, holotype.

GRYPOCERAS (*GRYPOCERAS*) *AEMULANS* (Koken MS) n. sp.

Plate 2, figure 4

Only one moderately well preserved specimen is available for study. It consists of a complete phragmocone and only a quarter volution of body chamber. The conch measures 60 mm. in diameter; the most adoral part of the last whorl measures 30 mm. in height and 27 mm. in width. The umbilicus is 10 mm. in diameter. The whorl sides are convex and converge toward the venter. The ventral shoulders are angular. The venter is broad and slightly arched. The umbilical shoulders are sharply rounded and the umbilical walls vertical. The suture forms a very shallow ventral lobe, and a broad sweeping lateral lobe. The position of the siphuncle is not known; it is not, however, in a near ventral position. No part of the shell is preserved.

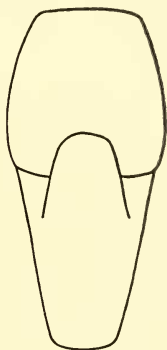


Fig. 2. Diagrammatic cross-section of *Grypoceras* (*Grypoceras*) *aemulans* n. sp., X1.

Remarks. *Grypoceras* (*Grypoceras*) *aemulans* differs from *G. (G.) bidorsatoides* in being more compressed and in having an arched venter, not concave on any part of the conch. *G. (G.) brahmanicum* is more evolute and with rounded ventral shoulders. *G. (G.) hexagonalis* differs also in its greater involution and in the shape of the whorl section. *G. (G.) aemulans* like *G. (G.) bidorsatoides* is similar to late Paleozoic domatoceratids except for the greater involution of the conch.

Occurrence. Lower Ceratite Marl, zone of *Prionolobus rotundatus*, Chideru, Salt Range, Pakistan.

Repository. B.M.N.H. C47068, holotype.

Genus *MENUTHIONAUTILUS* Collignon, 1933

Type species. *Nautilus (Menuthionautilus) kieslingeri* Collignon, 1933

MENUTHIONAUTILUS KIESLINGERI Collignon

Plate 1; figures 3, 4; plate 2, figures 1-3

Nautilus (Menuthionautilus) kieslingeri Collignon, 1933, *Annales de Paleontologie*, tome 22, pp. 164-166, pl. 1, figs. 1, 1a.

Four incomplete but well preserved specimens of this interesting species are available. The conch is involute, compressed, and smooth.

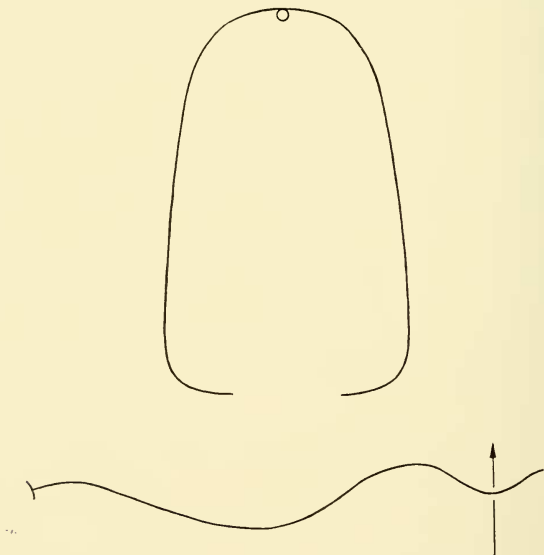


Fig. 3. Diagrammatic cross-section and representation of an external suture of *Menuthionautilus kieslingeri*, X1.

The whorls are much higher than wide. The largest specimen (pl. 2, fig. 1) has a whorl height of 67 mm. and a width of approximately 41 mm. The whorl sides are slightly convex and converge toward the venter. The ventral shoulders are well rounded and the venter broadly arched (text fig. 3).

The umbilicus is small in diameter. On the figured paratype (pl. 2, fig. 3), 40 mm. in diameter, the umbilicus measures 6 mm. The umbilical shoulders are abruptly rounded and the umbilical wall convex and vertical. The suture forms a shallow, acutely rounded ventral lobe, a broad, rather prominent lateral lobe which occupies the whole whorl side ending at an indistinct saddle on the umbilical wall. The siphuncle is in an extreme ventral position and in the largest specimen measures 2 mm. in diameter. The ventral position of the siphuncle is well illustrated in the immature specimen figured on Plate 1, figure 3.

Remarks. Collignon's specimen came from the Lower Triassic (Seythian) formation at Barabanja, Madagascar. The Salt Range specimens described and figured here are very similar in nearly all features to the type specimen from Madagascar. The Salt Range forms are the only other recorded specimens of this genus and species.

Collignon (1933) established *Menuthionutilus* as a subgenus of *Nautilus* and he recognized the uniqueness of this Triassic nautiloid with its ventral siphuncle. He compared his species with *Paranautilus* and *Grypoceras*. There appears to be little actual affinity with *Paranautilus*. The *Paranautilidae* are a stock that tended toward involute, globular conchs and simplified septa. There are very few compressed species of *Paranautilus*, *Indonutilus*, or *Sibyllonutilus*. The *Paranautilidae* stem from the upper Paleozoic *Liroceratidae* and themselves gave rise to the *Clydonautilidae* of the Upper Triassic with their very sinuous sutures.

The inner whorls of *Menuthionutilus* are more quadratic in cross section, having low arched venters and sharply rounded ventral shoulders. The characters of the conch of *Menuthionutilus* show clearly affinities to *Grypoceras* of the Triassic and *Grypoceras* (*Domatoceras*) of the Pennsylvanian and Permian. The *Grypoceratidae* include the following genera: *Grypoceras*, *Grypoceras* (*Domatoceras*), *Stenopoceras*, *Steatoceras*, *Titanoceras*, *Menuthionutilus*, and *Gryponutilus*. The evolutionary patterns in this family show three main trends: (a) towards involution, (b) towards rounding of the ventral shoulders, and (c) towards greater sinuosity of the suture. At the same time there is great variability in the position of the siphuncle among the

various species. In an analysis of 10 species of *G. (Domatoceras)* the percentage of the distance from the venter to the siphuncle, to the height of the whorl varied from 12.5 to 50. The same measurements for species of *Grypoceras* range from 30 to 50 per cent. As mentioned above under the discussion of *Grypoceras* and *G. (Domatoceras)* these two forms are believed to belong to a continuous evolutionary series. *Menuthionautilus* is most likely a development out of this *Domatoceras-Grypoceras* line. The similarity of the whorl section, general plan of the suture, and known variability of the siphuncle in the parent stock strongly support this relationship.

Occurrence. Lower Ceratite Marl, zone of *Prionolobus rotundatus*, Chideru, Salt Range, Pakistan.

Repository. B.M.N.H. C10433 (pl. 2, fig. 1), C10438a (pl. 1, figs. 3, 4), C10438b (pl. 2, fig. 3), C10438c (pl. 2, fig. 2).

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